6. Abstract

This study examines the growth of human bone derived cells on the following dental implant surfaces: porous titanium plasma-sprayed coating (Ti-TPS), acid etched and sand-blasted titanium (Ti-DPS), uncoated titanium substrate with machined surface (Ti-ma), a plasma-sprayed hydroxyapatite coating (Ti-HA) and calcium titanium phosphate coatings (CTP-S1, CTP-S2, CTZP-S2 and CTP-S3). Specimens were evaluated using scanning electron microscopy after 3, 5, 7, 14 and 21 days of incubation.

A rat bone marrow stromal cell (RBM) culture system was used to evaluate the following bioactive bone substitute materials: Bioglass 45s5, 52s, 55s, 60s and glas-ceramic Ceravital. Alumina, which is an inert ceramic material served as control. RBMs were grown on the bone substitutes for 1, 3, 7, 14, 21 and 28d. The cellular behaviour was evaluated utilizing scanning electron microscopy. Atomic Absorption Spectrometry (AAS) was used to measure the sodium, phosphate and silicon concentrations in the cell culture medium in order to evaluate the ion release from the various bioactive glasses. EDX analysis was applied in order to detect mineralisation of the extracellular matrix. Ti-ma and Ti-DPS supported excellent cell growth and extracellular matrix formation. Also Ti-TPS enhanced cellular growth at the early time points. CTP-S2 and CTZP-S2 exhibited a stimulatory effect on osteoblast growth and extracellular matrix formation at 21 d. CTP-S1 did not support favourable osteoblast growth.

With Bioglass 45s5, there was a significant increase in calcium concentration in the cell culture medium. The electron micrographs did not demonstrate favorable support of osteogenesis for Ceravital or alumina ceramics.

In general, osteogenesis and cell-biomaterial interactions are influenced by the chemistry of the implant surface, implant topography and the crystallinity of calcium phosphate coatings. The effect of these parameters is discussed in the context of the findings obtained in the current study.